

at drop must be statistically random, but direct impact on the valve or valve closure must be avoided.

(2) *Criteria for passing the drop test:* The containers must not break or leak.

(b) Design qualification testing must be completed if the design is manufactured with a new mold or if there is any change in the properties of the material of construction.

[75 FR 73, Jan. 4, 2010]

#### § 178.33b-8 Production tests.

(a) *Burst Testing.* (1) One out of each lot of 5,000 containers or less, successively produced per day must be pressure tested to destruction and must not burst below 240 psig. The container tested must be complete as intended for transportation.

(2) Each such 5,000 containers or less, successively produced per day, shall constitute a lot and if the test container shall fail, the lot shall be rejected or ten additional containers may be selected at random and subjected to the test under which failure occurred. These containers shall be complete as intended for transportation. Should any of the ten containers thus tested fail, the entire lot must be rejected. All containers constituting a lot shall be of like material, size, design construction, finish, and quality.

(b) [Reserved]

[74 FR 2268, Jan. 14, 2009, as amended at 75 FR 74, Jan. 4, 2010]

#### § 178.33b-9 Marking.

(a) Each container must be clearly and permanently marked to show:

(1) DOT-2S.

(2) Name or symbol of person making the mark specified in paragraph (a)(1) of this section. Symbol, if used, must be registered with the Associate Administrator.

(b) [Reserved]

[74 FR 2268, Jan. 14, 2009]

### Subpart C—Specifications for Cylinders

#### § 178.35 General requirements for specification cylinders.

(a) *Compliance.* Compliance with the requirements of this subpart is required in all details.

(b) *Inspections and analyses.* Chemical analyses and tests required by this subchapter must be made within the United States, unless otherwise approved in writing by the Associate Administrator, in accordance with subpart I of part 107 of this chapter. Inspections and verification must be performed by—

(1) An independent inspection agency approved in writing by the Associate Administrator, in accordance with subpart I of part 107 of this chapter; or

(2) For DOT Specifications 3B, 3BN, 3E, 4B, 4BA, 4D (water capacity less than 1,100 cubic inches), 4B240ET, 4AA480, 4L, 8, 8AL, 4BW, 39 (marked service pressure 900 p.s.i.g. or lower) and 4E manufactured in the United States, a competent inspector of the manufacturer.

(c) *Duties of inspector.* The inspector shall determine that each cylinder made is in conformance with the applicable specification. Except as otherwise specified in the applicable specification, the inspector shall perform the following:

(1) Inspect all material and reject any not meeting applicable requirements. For cylinders made by the billet-piercing process, billets must be inspected and shown to be free from pipe, cracks, excessive segregation and other injurious defects after parting or, when applicable, after nick and cold break.

(2) Verify the material of construction meets the requirements of the applicable specification by—

(i) Making a chemical analysis of each heat of material;

(ii) Obtaining a certified chemical analysis from the material manufacturer for each heat of material (a ladle analysis is acceptable); or

(iii) If an analysis is not provided for each heat of material by the material manufacturer, by making a check analysis of a sample from each coil, sheet, or tube.

(3) Verify compliance of cylinders with the applicable specification by—

(i) Verifying identification of material is proper;

(ii) Inspecting the inside of the cylinder before closing in ends;

(iii) Verifying that the heat treatment is proper;

(iv) Obtaining samples for all tests and check chemical analyses (NOTE: Recommended locations for test specimens taken from welded cylinders are depicted in Figures 1 through 5 in Appendix C to this subpart for the specific construction design.);

(v) Witnessing all tests;

(vi) Verify threads by gauge;

(vii) Reporting volumetric capacity and tare weight (see report form) and minimum thickness of wall noted; and

(viii) Verifying that each cylinder is marked in accordance with the applicable specification.

(4) *Inspector's report.* Prepare a report containing, at a minimum, the applicable information listed in CGA C-11 (IBR, see §171.7 of this subchapter). Any additional information or markings that are required by the applicable specification must be shown on the test report. The signature of the inspector on the reports certifies that the processes of manufacture and heat treatment of cylinders were observed and found satisfactory. The inspector must furnish the completed test reports required by this subpart to the maker of the cylinder and, upon request, to the purchaser. The test report must be retained by the inspector for fifteen years from the original test date of the cylinder.

(d) *Defects and attachments.* Cylinders must conform to the following:

(1) A cylinder may not be constructed of material with seams, cracks or laminations, or other injurious defects.

(2) Metal attachments to cylinders must have rounded or chamfered corners or must be protected in such a manner as to prevent the likelihood of causing puncture or damage to other hazardous materials packages. This requirement applies to anything temporarily or permanently attached to the cylinder, such as metal skids.

(e) *Safety devices.* Pressure relief devices and protection for valves, safety devices, and other connections, if applied, must be as required or authorized by the appropriate specification, and as required in §173.301 of this subchapter.

(f) *Markings.* Markings on a DOT Specification cylinder must conform to applicable requirements.

(1) Each cylinder must be marked with the following information:

(i) The DOT specification marking must appear first, followed immediately by the service pressure. For example, DOT-3A1800.

(ii) The serial number must be placed just below or immediately following the DOT specification marking.

(iii) A symbol (letters) must be placed just below, immediately before or following the serial number. Other variations in sequence of markings are authorized only when necessitated by a lack of space. The symbol and numbers must be those of the manufacturer. The symbol must be registered with the Associate Administrator; duplications are not authorized.

(iv) The inspector's official mark and date of test (such as 5-95 for May 1995) must be placed near the serial number. This information must be placed so that dates of subsequent tests can be easily added. An example of the markings prescribed in this paragraph (f)(1) is as follows:

DOT-3A1800  
1234  
XY  
AB 5-95

Or;

DOT-3A1800-1234-XY  
AB 5-95

Where:

DOT-3A = specification number  
1800 = service pressure  
1234 = serial number  
XY = symbol of manufacturer  
AB = inspector's mark  
5-95 = date of test

(2) Additional required marking must be applied to the cylinder as follows:

(i) The word "spun" or "plug" must be placed near the DOT specification marking when an end closure in the finished cylinder has been welded by the spinning process, or effected by plugging.

(ii) As prescribed in specification 3HT (§178.44) or 3T (§178.45), if applicable.

(3) *Marking exceptions.* A DOT 3E cylinder is not required to be marked with an inspector's mark or a serial number.

(4) Unless otherwise specified in the applicable specification, the markings on each cylinder must be stamped plainly and permanently on the shoulder, top head, or neck.

(5) The size of each marking must be at least 0.25 inch or as space permits.

(6) Other markings are authorized provided they are made in low stress areas other than the side wall and are not of a size and depth that will create harmful stress concentrations. Such marks may not conflict with any DOT required markings.

(g) *Manufacturer's reports.* At or before the time of delivery to the purchaser, the cylinder manufacturer must have all completed certification documents listed in CGA C-11. The manufacturer of the cylinders must retain the reports required by this subpart for 15 years from the original test date of the cylinder.

[Amdt. 178-114, 61 FR 25942, May 23, 1996, as amended at 66 FR 45185, Aug. 28, 2001; 67 FR 51652, Aug. 8, 2002; 68 FR 75748, Dec. 31, 2003; 76 FR 43531, July 20, 2011]

#### § 178.36 Specification 3A and 3AX seamless steel cylinders.

(a) *Type size and service pressure.* In addition to the requirements of § 178.35, cylinders must conform to the following:

(1) A DOT-3A cylinder is a seamless steel cylinder with a water capacity (nominal) not over 1,000 pounds and a service pressure of at least 150 psig.

(2) A DOT-3AX is a seamless steel cylinder with a water capacity not less than 1,000 pounds and a service pressure of at least 500 psig, conforming to the following requirements:

(i) Assuming the cylinder is to be supported horizontally at its two ends only and to be uniformly loaded over its entire length consisting of the weight per unit of length of the straight cylindrical portion filled with water and compressed to the specified test pressure; the sum of two times the maximum tensile stress in the bottom fibers due to bending, plus that in the same fibers (longitudinal stress), due to hydrostatic test may not exceed 80 percent of the minimum yield strength of the steel at such maximum stress. Wall thickness must be increased when necessary to meet the requirement.

(ii) To calculate the maximum longitudinal tensile stress due to bending, the following formula must be used:

$$S = Mc/I$$

(iii) To calculate the maximum longitudinal tensile stress due to hydrostatic test pressure, the following formula must be used:

$$S = A_1 P/A_2$$

where:

S = tensile stress—p.s.i.;

M = bending moment—inch pounds—(wl<sup>2</sup>)/8;

w = weight per inch of cylinder filled with water;

l = length of cylinder—inches;

c = radius (D)/2 of cylinder—inches;

I = moment of inertia—0.04909 (D<sup>4</sup> – d<sup>4</sup>) inches fourth;

D = outside diameter—inches;

d = inside diameter—inches;

A<sub>1</sub> = internal area in cross section of cylinder—square inches;

A<sub>2</sub> = area of metal in cross section of cylinder—square inches;

P = hydrostatic test pressure—psig.

(b) *Steel.* Open-hearth or electric steel of uniform quality must be used. Content percent may not exceed the following: Carbon, 0.55; phosphorous, 0.045; sulphur, 0.050.

(c) *Identification of material.* Material must be identified by any suitable method, except that plates and billets for hot-drawn cylinders must be marked with the heat number.

(d) *Manufacture.* Cylinders must be manufactured using equipment and processes adequate to ensure that each cylinder produced conforms to the requirements of this subpart. No fissure or other defect is permitted that is likely to weaken the finished cylinder appreciably. A reasonably smooth and uniform surface finish is required. If not originally free from such defects, the surface may be machined or otherwise treated to eliminate these defects. The thickness of the bottoms of cylinders welded or formed by spinning is, under no condition, to be less than two times the minimum wall thickness of the cylindrical shell; such bottom thicknesses must be measured within an area bounded by a line representing the points of contact between the cylinder and floor when the cylinder is in a vertical position.

(e) *Welding or brazing.* Welding or brazing for any purpose whatsoever is prohibited except as follows:

(1) Welding or brazing is authorized for the attachment of neckrings and footrings which are non-pressure parts